

CLAIMS

- 1 1. In a bone implant for a bony substance having an implant body with a
2 surface that is compatible with bone cells having an average size and
3 wherein the surface has a macrostructure that contacts the bony substance
4 and a microstructure for anchoring the implant in the cell area, the
5 improvement wherein the microstructure comprises an array of densely
6 packed rounded domes separated by rounded lacunae, and wherein the
7 size of the domes, their distances from one another and the depth of the
8 lacunae are substantially the same order of magnitude as the average size
9 of the bone cells.
- 1 2. The improvement of claim 1, wherein parts of the implant body surface are
2 pretreated by sandblasting and acid etching and wherein the microstructure
3 comprises a cover layer formed on the implant body surface parts.
- 1 3. The improvement of claim 2 wherein the cover layer is fabricated from a
2 material in the group consisting of titanium and titanium alloys.
- 1 4. The improvement of claim 2 wherein the bone cells have a profile with a
2 surface roughness and wherein the cover layer comprises a layer of
3 sputtered material having a thickness which corresponds substantially to the
4 surface roughness of the bone cell profile.
- 1 5. The improvement of one of claims 2-4 wherein the cover layer has a
2 thickness between 0.1 and 2 micrometers.
- 1 6. The improvement of one of claims 2-4, wherein implant body surface parts
2 which are pretreated by sandblasting and acid etching and on which is

3 formed the cover layer are delineated from other surface parts of the implant
4 by masking.

1 7. The improvement of claim 1 further comprising a nanostructure
2 superimposed on the microstructure, the nanostructure being comprised of
3 a densely packed array of rounded domes separated by rounded lacunae,
4 wherein the size of the nanostructure domes, the distances from one
5 nanostructure dome to another and the depth of the nanostructure lacunae
6 are smaller than the corresponding dimensions of the microstructure by
7 approximately one decimal order of magnitude.

1 8. The improvement of claim 7, wherein the depth of the nanostructure lacunae
2 is in the range of 10-500 nm wherein and the distance between
3 nanostructure domes is in the range of 100-500 nm.

1 9. A method of producing a bone implant that is compatible with bone cells
2 having an average size, the method comprising:

- 3 (a) fabricating an implant body with a biocompatible surface,
- 4 (b) pretreating parts of the implant body surface to roughen the implant
5 body surface;
- 6 (c) reshaping the roughened implant body surface by application and
7 removal of material to create a microstructure comprised of an array
8 of densely packed rounded domes separated by rounded lacunae;
9 and
- 10 (d) selecting parameters of steps (b) and (c) so that a size of the domes,
11 distances from one dome to another and a depth of the lacunae are
12 substantially the same order of magnitude as the average size of the
13 bone cells.

- 1 10. The method of claim 9 wherein step (b) comprises sandblasting the implant
- 2 body surface.

- 1 11. The method of claim 9 wherein step (b) comprises acid etching the implant
- 2 body surface.

- 1 12. The method of claim 9 wherein step (b) comprises sandblasting the implant
- 2 body surface and acid etching the sandblasted implant body surface.

- 1 13. The method of any one of claims 8-12, wherein step (c) comprises applying
- 2 a cover layer to the roughened implant body surface.

- 1 14. The method of claim 13, wherein step (c) comprises applying the cover layer
- 2 by sputtering.

- 1 15. The method of claim 13, wherein step (c) comprises applying the cover layer
- 2 by electroplating.

- 1 16. The method of any one of claims 9-12, wherein step (c) comprises treating
- 2 the roughened implant body surface with a laser so that roughness peaks
- 3 produced by step (b) are worn down and notch-like indentations are
- 4 reshaped to form rounded lacunae.

- 1 17. The method of any one of claims 9-12, wherein step (c) comprises treating
- 2 the roughened implant body surface by a galvanic erosion process so that
- 3 roughness peaks produced by step (b) are worn down and sharp-edged
- 4 indentations are filled up to form rounded lacunae.

1 18. The method according to claim 17, wherein the roughened implant body
2 surface functions as a cathode in the galvanic erosion process for removal
3 of the roughness peaks.

1 19. The method of claim 15, wherein the cover layer is applied up to a thickness
2 that corresponds substantially to a surface roughness of a bone cell profile.

1 20. The method of claim 19, wherein the cover layer is applied to a thickness
2 between 0.1 and 2 micrometers.

1 21. The method of claim 9, wherein the implant body surface parts to be treated
2 in step (b) and step (c) are delineated from other surface parts of the implant
3 body by masking, and the other surface parts are covered while the method
4 steps (b) and (c) are being carried out.

1 22. The method of claim 9, wherein step (a) comprises fabricating an implant
2 body with a macrostructure to fasten the implant body into bone and
3 wherein the microstructure formed by steps (b) and (c) is applied to the
4 macrostructure.

1 23. The method of claim 9, further comprising:
2 (e) forming a nanostructure on the microstructure, the nanostructure
3 being formed by an array of rounded domes separated by rounded
4 lacunae wherein a size of the nanostructure domes, a spacing
5 between the nanostructure domes and a depth of the nanostructure
6 lacunae are substantially one decimal order of magnitude smaller
7 than corresponding dimensions of the microstructure.

24. The method of claim 23, wherein the depth of the nanostructure lacunae is in the range of 10-500 nm and the spacing between the nanostructure domes is in the range of 100-500 nm.